DOCUMENT RESUME

ED 402 152 SE 058 897

AUTHOR Lee, Thomas
TITLE Biotechnology Education and the Internet. ERIC Digest.
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO EDO-SE-96-5
PUB DATE Sep 96
CONTRACT RI93002013
NOTE 4p.
AVAILABLE FROM ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 1929 Kenny Road, Columbus, OH 43210-1080.
PUB TYPE Information Analyses - ERIC Clearinghouse Products (071) -- Reference Materials - Bibliographies (131)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Agriculture; Biochemistry; Bioethics; *Biotechnology; Educational Resources; Genetic Engineering; Higher Education; *Internet; Molecular Biology; Secondary Education
IDENTIFIERS *Alternative Assessment; ERIC Digests

ABSTRACT

The world of modern biotechnology is based on recent developments in molecular biology, especially those in genetic engineering. Since this is a relatively new and rapidly advancing field of study, there are few traditional sources of information and activities. This digest highlights biotechnology resources including those that can be found on the Internet, World Wide Web, and other sources. The resources presented here relate to topics that have been identified as main areas of study in biotechnology: bioprocessing, foundations, genetic engineering, agriculture, biochemistry, medicine, environment, and bioethics. Topics include: (1) Web Guides and Tools; (2) Major Starting Points; (3) Agricultural Biotechnology; (4) Mailing Lists; (5) Newsgroups; (6) Books, Journals, and Periodicals; (7) Bioethics; (8) International Biotechnology; (9) Regulation and Patents; and (10) Federal Government. (JRH)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

# Biotechnology Education and the Internet

*Thomas Lee*

September 1996

ERIC Clearinghouse for Science, Mathematics, and Environmental Education DIGEST

ED 402 152

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SE 058 897

BEST COPY AVAILABLE

# Biotechnology Education and the Internet

*Thomas Lee*

September 1996

ERIC Clearinghouse for Science, Mathematics, and Environmental Education DIGEST

The world of modern biotechnology is based on recent developments in molecular biology, especially those in genetic engineering. Organisms from bacteria to cows are being genetically modified to produce pharmaceuticals and foods. Also, new methods of disease gene isolation, analysis, and detection, as well as gene therapy, promise to revolutionize medicine. With these changes come controversies as well. There are, for example, concerns about genetic privacy, the effects of transgenic organisms on other organisms and the environment, and animal rights.

How can teachers and students keep up with what is happening in biotechnology? Biotechnology is a relatively new and rapidly advancing field of study, so there are few traditional sources of information and activities. The National Association has produced *A Sourcebook of Biotechnology Activities* (Rasmussen & Matheson, 1990), and the Ohio Academy of Science has produced *The Ohio Science Workbook: Biotechnology* (Reames, 1993). To encourage an international exchange of ideas regarding biotechnology education, the UNESCO Science and Technology Programme has published a document on *Teaching Biotechnology in Schools* (McInerney, 1990) that provide information on both the basic principles of biotechnology as well as ethical and social considerations.

Other good sources of information and ideas can be found on the Internet, using the World Wide Web and other services. The resources presented here relate to topics that have been identified (Wells, 1994) as the main areas of study in biotechnology: bioprocessing, foundations, genetic engineering, agriculture, biochemistry, medicine, environment, and bioehtics. Resouces for other topics, such as aquaculture, DNA fingerprinting, and biotechnology education have been listed by Paolella (1991).

### Web Guides and Tools

There are several major starting points for finding information on the Web. On-line subject guides list topics (like biotechnology) alphabetically, and offer direct links to resources. Try Yahoo at *http://www.yahoo.com*, EINet Galaxy at *http://galaxy.einet.net/galaxy.html*, or the incredible WWW Virtual Library at *http://www.w3.org/hypertext/DataSources/bySubject/Overview.html*.

If you want to use a system that will search for a topic for you throughout the Internet , use one of the many Web search tools. Yahoo, listed above, will perform searches, as will Lycos at *http://www.lycos.com*, Alta Vista at *http://www.altavista.digital.com*, or Infoseek Guide at *http://guide.infoseek.com*. If you prefer one-stop shopping, use *http://cuiwww.unige.ch/meta-index.html*. There you can access all of the above and more. Warning, a recent search for the term "biotechnology" on Lycos yielded 5400 sites. You might want to be more specific!

### Major Starting Points

There are other ways to find biotechnology-related information. Access Excellence, at *http://www.gene.com/ae* is a forum for on-line communication among high school biology teachers, with a focus on biotechnology. One can exchange messages, post notices, and obtain teaching activities. While at Access Excellence, look under "Resource Center." Carolina Biological Supply posts its newsletter, *Carolina Tips*, there.

Other rich sources include *http://golgi.harvard.edu/biopages.html*, the Biotechnology Information Center (BIC) at the National Agricultural Library at *http://www.inform.umd.edu/EdRes/Topic/AgrEnv/Biotech*, and the Biotechnology Public Education Program site residing at *http://biotech.zool.iastate.edu/Biotech_Public_Ed.html*. Also visit the Internet Directory of Biotechnology Resources at *http://biotech.chem.indiana.edu* and the Biotechnology Industry Organization's gateway to biotechnology resources at *http://www. bio.org*.

### Agricultural Biotechnology

Agriculture, which includes animals as well as crops, is an area filled with promise and also controversy over biotechnological developments. The Global Agricultural Biotechnology Association offers a very informative site at *http://www.lights.com/gaba/index.html*. BIC, listed above, is a great source as well. Go to *http://www.bio.com/bc/bio/foodrep8.html* for a listing of "Biotechnology Food Products on the Market", and much more. The U.S. Department of Agriculture is on-line at *http://www.usda.gov*. A good way to keep up on the latest news is to read the monthly News Report of the NBIAP, assessing the biological impacts of agricultural biotechnology, at *http://nbiap.biochem.vt.edu*.

### Mailing Lists

There are lists to which one can subscribe, and then receive (or post) e-mail notices. They are a valuable means of getting updates, asking questions and sharing information. Subscribing is easy; just send an e-mail to the list's address, (don't list a subject!) and put the following message in the body: *Subscribe (name of list) firstname lastname*. Here are some useful addresses.

- GENTECH supports discussions about genetic engineering through *GENTECH-REQUEST@doo.donut.ruhr.com*.
- BIOPI-L networks teachers and science education specialists at *listserv@ksuvm.ksu.edu*.
- BCEPP enables people working in education as well as public policy to to exchange ideas. Subscribe to: *listserver@relay.adp.wisc.edu*.
- GENTALK addresses genetic engineering and bioethical issues at *listproc@usa.net*.

Another biotechnology discussion group is BIOTECH, at listserv@umdd.umd.edu. Also, try HUM-MOLGEN BIOTECHNOLOGY, a mailing list which includes lots of references to human genetics. Subscribe to HUM-MOLGEN at *listserv@nic.surfnet.nl*. After your name, add (BIOT).

### Newsgroups

Instead of sending you e-mail, the

newsgroups send their notices to whatever computer system you are using. You can then go to your account and read these at your convenience. Talk with your systems operator about how to sign on.

A complete list of all BIOSCI/bionet newsgroups is available through *http://www.bio.net*. Here you can get not only the list, but you can actually search through the newsgroups archives to find out what has already been said on your subject. *Bionet.announce* and *bionet.gen-eral* are good ones to watch here.The sci.bio newsgroups include the useful sci.bio.technology.

**Books, Journals, and Periodicals**

Would you like to search for books, browse through the table of contents of thousands of journals and periodicals, or even search for a topic in the literature by keywords, authors, or subjects? Simply go to the Library Resources Page, *http://www.nova.edu/Inter-Links/library.html*. There are also lots of biotechnology-related articles in popular magazines that can be located at the Electronic Newsstand, *http://www.enews.com*.

**Bioethics**

Bioethical topics are popular subjects for classroom discussion. To project more enlightenment than argument, you can keep current by checking several Web sites. A major starting point is *http://fas-www.harvard. edu/~blom/bioethics.html*. The Center for Biotechnology Policy & Ethics is at *http:// www.tamu.edu/cbpe*.

The AgBioethics Forum is on-line at *http://www.public.iastate.edu/~grad_college/bioethics*. If you are interested in any aspect of the ethical issues of human genome research as it relates to biotechnology, go to *http://www.nchgr. nih.gov*, and you can search by keyword in the archives of The National Center for Genome Research. The Center's home page at *http://www.ncgr.org* offers several updated pages on ELSI, the committee studying the ethical, legal, and social implications of genetic science.

A very interesting site is offered by the National Center for Biotechnology Education (NCBE) in the United Kingdom. Within the vast array of data is a link to the Biotechnology Debate Project. Here is a wealth of background information on biotechnology topics. The Project also features a running debate and voting on issues such as bST in milk ( banned for now in Europe) and genetic screening. Direct access to the Project is through *http://www.aladdin.co.uk/cfinney/biosis/welcome.html*.

**International Biotechnology**

Biotechnology is a global enterprise. You can check up on the the Canadian biotechnology scene with *http://www.ibc.nrc.ca/ibc*. The Australian Biotechnology Association has a home page at *http://www.aba.asn.au*. The United Kingdom is covered at *http://www.reading.ac.uk/NCBE*. In the U.S., if you would like a listing of many biotechnology companies, along with their Internet addresses,try *http://www.data-transport.com*.

**Regulation and Patents**

The biotechnology industry is subject to legal regulation in many areas such as clinical testing, release of genetically engineered organisms into the environment, or the introduction of foreign genes into our foods. There is much public debate over the patenting of life forms by biotechnologists. Legal and scientific information is offered at *http://biotechlaw.ari.net*. At this site you also will find links leading to news about gene patents and other biotechnology-related patents. You can also find lots of good background reading at *http://www.aphis.usda.gov*.

To read selected full-text patents try *http://www.inform.umd.edu/EdRes/Topic/AgrEnv/Biotech/Biotechnology_Patents-full_text*. For lots of news about releases and patents try *http://binas.unido.org/binas/binas.html*, sponsored by the United Nations International Development Organization (BINAS). Another major source treating release of genetically modified organisms is *http://www.bdt.org.br/irro/irro.html*.

Relative to these issues, the Rural Advancement Foundation International (RAFI) sponsors a Web site at *http://www.charm.net/~rafi/rafihome.html*. They are interested in the "socially responsible development of technologies useful to rural societies." Some topics at that site are "Impacts of New Transgenic Crops on Southern Farmers", and "Companies Staking Claim to the Human Genome."

**Federal Government**

The various agencies of the Federal Government, many of which regulate or sponsor biotechnology research and development, publish an enormous amount of material on the Internet. Congress has a Web site at *http://thomas.loc. gov* which will link you to a vast array of government documents. Also try FedWorld at *http://www.fedworld.gov*. Another way into the maze is *http://www.inform.umd.edu/EdRes/Topic/AgrEnv/Biotech/Other_Federal_ Biotechnology_Documents*.

**Conclusion**

The Internet, while it does not replace the traditional documents needed by students and educators (e.g. books, periodicals or indexes), is an extraordinarily rich and constantly growing network of information and communication. Biotechnology, in all of its many dimensions, is expanding rapidly as well. Use e-mail, newsgroups, connect to the Web to stay informed, and enter the fascinating world of modern science—as it happens.

**References**

McInerney, J. D. (Ed.). (1990). *Teaching biotechnology in schools. Science and technology education document series No. 39*. Paris: UNESCO. [ED 352 250]

Paolella, M.J. (1991). Biotechnology outlines for classroom use. *American Biology Teacher, 53*(2), 98-101.

Rasmussen, A.M., & Matheson, R. H. (Eds.). (1990). *A sourcebook of biotechnolgy activities*. Washington, DC: National Association of Biology Teachers. [ED 361 177]

Reames, S. E. (1993). *The Ohio science workbook: Biotechnology*. Columbus: Ohio Academy of Science. [ED 362 405]

Wells, J. G. (1994). Establishing a taxonomic structure for the study of biotechnology in secondary school technology education. *Journal of Technology Education, 6*(1).

**About the Author**

Dr. Thomas F. Lee is a professor of biology at St. Anselm College, Manchester, NH where he teaches microbiology and biotechnology courses. His most recent book, *Gene Future: The Promise and the Perils of the New Biology*, is available from Plenum Press. He can be contacted by e-mail at: *tomlee@anselm.edu*.

SE 058 897

➤ This digest is in the public domain and may be freely reproduced. ◄

EDO-SE-96-5

This digest was funded by the Office of Educational Research and Improvement, U.S. Department of Education under contract no. RI-93002013. Opinions expressed in this digest do not necessarily reflect the positions or policies of OERI or the Department of Education.

OERI

ERIC

The Educational Resources Information Center is a nationwide information system initiated in 1966 by the U.S. Department of Education. ERIC has developed the largest and most frequently used education-related database in the world. For information, call 1-800-538-3742.



BEST COPY AVAILABLE